(Model.)

E. E. CLARK.

ELLIPSOGRAPH.

No. 256,462. Patented Apr. 18, 1882.

Fig. 4.

TABLE
FOR DISTANCES TO
BE SET ON MIDDLE ARM.

Semi short diameter.

Semi long diameter.	1/4	3/4	1	1 1/4	1 1/2	1 3/4	2
1	3/4	7/16	0				
1 1/4	1	11/32	1/2	0			
1 1/2	1 1/3	1 1/8	5/6	7/16	0		
1 3/4	1 3/8	1 3/8	1 1/4	6/7	1/2	0	
2	1 7/8	1 3/4	1 1/2	1 1/4	7/8	1/2	0

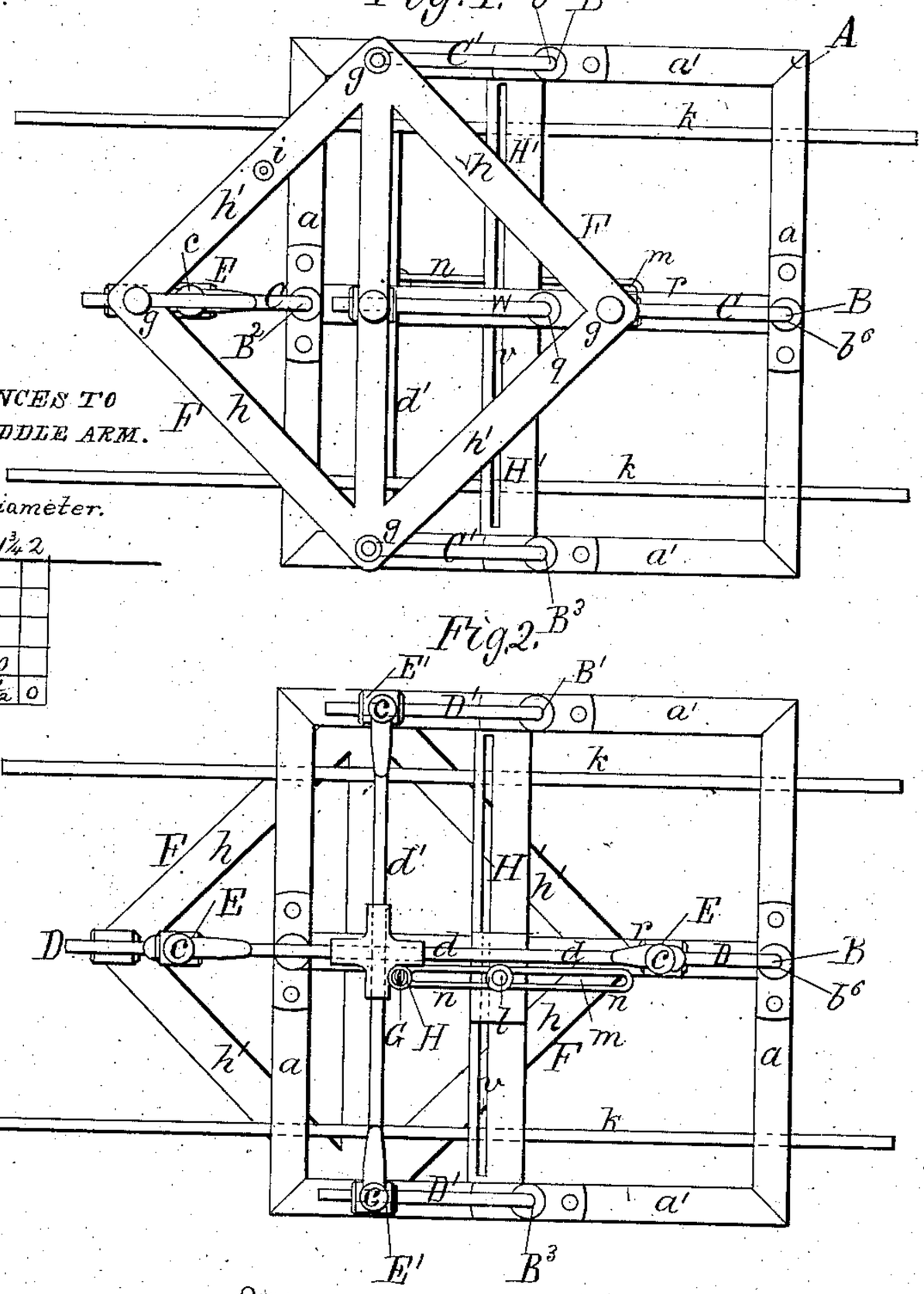
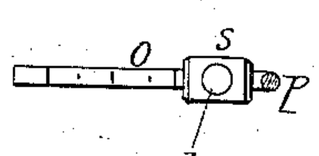


Fig. 1.

Fig. 2.

Fig. 3.



Witnesses.
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ELLIPSOGRAPH.

SPECIFICATION forming part of Letters Patent No. 256,462, dated April 18, 1882.

Application filed September 29, 1881. (Model.)

To all whom it may concern:

Be it known that I, EZRA E. CLARK, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in an Ellipsograph; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This instrument is designed for cutting or describing ellipses, and is applicable to draftsmen's uses for drawing pencil, ink, or dotted lines, or to the wants of picture-frame makers for cutting ovals from pasteboard, &c., for frames, besides being adapted to various useful purposes in the arts.

Two elementary features are embraced in this instrument, one being mechanism for causing the knife or pen stock to describe the desired ellipse, and the other mechanism for compelling the knife or pen to remain normal—that is, tangential to the curve being described by it, in order that such knife or pen shall operate to the best advantage in cutting or shedding ink.

The portion of the instrument for describing the ellipse consists of two straight rods or bars arranged in horizontal planes, one above the other, and crossing at right angles, the two rods at their point of intersection being inclosed in a common hub, which carries the pen-stock, and in which they slide independently of each other, and each rod being connected at its ends to twin swinging parallel arms or cranks, pivoted to the frame of the instrument, and operating to carry the rods through arcs of circles of greater or less diameter, one pair of arms or cranks being of necessity longer than the other, since the circle described by one rod must be of greater diameter than the other to produce an ellipse. The action of the longest pair of arms and their connecting-rod jointly with the shorter arms and their connecting-rod is such as to cause the knife or pen to describe an elliptical path of movement.

The portion of the instrument for maintaining the pen-stock normal to the curve being described—that is, for shifting the position of such pen-stock in consonance with the change in direction of the same—consists in pivoting said pen-stock vertically within the common hub before named, and securing to its upper end one end of a slotted plate or sweep which straddles a stud secured to a longitudinal cross-head, such cross-head being supported upon slide-bars playing in the upper part of the frame of the instrument, and having reciprocating rectilinear movement imparted to it between the points of oscillation of the plate or sweep which supports the pen-stock, and parallel to the longest axis of the ellipse by a suitable hand-crank carrying an adjustable stud or wrist-pin, which operates in a groove of the head by which the length of motion of the cross-head is controlled, in order that the speed of movement of said cross-head may be made to vary proportionately with the change in the curvilinear motion of the knife or pen, the combined movements of the two being such as to maintain the said slotted plate or sweep, and consequently the pen or knife, normal to the curve being described.

The drawings accompanying this specification represent, in Figure 1, a plan, Fig. 2 an under side view, and in Fig. 3 a vertical section, of an instrument embodying my improvements.

In the above-named drawings, A represents a square rectangular frame composed of side bars, *a a a' a'*, mounted in a horizontal plane upon suitable legs.

B B' B^2 B^3 represent short vertical shafts, mounted in bearings b^6, erected upon the centers of the bars *a a'*, and of course arranged in a quadrangle, each shaft having secured to its upper and lower end one end of a crank or arm, C C or C' C', and the entire series of cranks being always in parallelism.

Each lower crank, D D D' D', supports an adjustable wrist-pin in the form of a tubular slider or hub, E or E', and a clamp-screw, *c*, by which it may be clamped to the crank, such screw constituting the pivot of each end of a connecting-rod, *d* or *d'*, the rod *d* connecting the cranks D D and the rod *d'* the cranks D' D'. Consequently these rods or bars *d d'* stand

at right angles to each other and maintain this relative position.

As a means of actuating the two lower pairs, D D, D′ D′, of cranks, I connect the combined ends of the two upper pairs, C C, C′ C′, by a rectangular frame, F, the corners of which are pivoted respectively to such ends as shown at *g*, the four sides *h h h′ h′* of said frame F constituting bars or pitmen which unite the cranks, as shown. A suitable handle, *i*, is to be erected upon the top of one of the bars *h* or *h′* by means of which the instrument is put in motion.

The stock for supporting the knife, pen, or other instrument which is to describe the desired ellipse is shown at G as suspended from and pivoted within a hub, H, which has two horizontal passages, *e f*, bored through it at right angles to each other, such passages receiving the rods *d d′*, which are capable of sliding freely within them.

Each arm or crank D D′ is to have a scale of divisions—say of inches and fractions of an inch—engraved upon its upper surface, for enabling the hubs E or E′ to be readily and accurately adjusted to the desired position according to the size and proportions of the ellipse to be described. In the present instance the cranks or arms D′ D′ are the longest. Hence the curved sweep described by them and their rod *d′* carries the pen or knife through the longest sides of the ellipse, while the arms D D and rod *d* carry the knife or pen through the shortest curves or ends of said ellipse, the rods *d d′* sliding with different rates of speed through the hub H. Therefore it will be seen that by changing the relative positions of the wrist-pins or hubs E E′ upon their cranks the size, as well as the proportions, of the ellipse will be varied.

To maintain the knife or pen normal to the curve being described by it, in order that if a knife it may cut to the best advantage, and if a pen shed ink most effectively, I proceed as follows:

H′ represents a horizontal bar or cross-head disposed at the upper part of the frame A, and parallel to the rod *d′* and the shortest axis of the ellipse, and supported in position upon horizontal parallel bars *k k*, which play in passages or bearings in the bars *a a* of the frame A, the cross-head thus supported being susceptible of reciprocating rectilinear movements in consonance and parallel with the rod *d′* and between the center or points of oscillation of the plate supporting the pen stock to be described.

To the under side of the cross head or bar H′, and centrally of it, I affix a pendent stud or pivot, *l*, which enters a slot, *m*, in a horizontal plate or sweep, *n*, one end of which is secured to the upper end of the pen-stock, such slotted plate or sweep being arranged at right angles to the plane of the knife or pen and adapted to stand parallel with the rod *d* or *d′* when either of such rods is parallel with one axis of the ellipse. It is evident that if this slotted plate or sweep be maintained at right angles to the curve at every point the knife or pen will remain in the proper position to cut or shed ink to the best advantage. The sliding carriage or cross-head H′ is introduced for this purpose, and its length of motion must be varied with variations in the size of the ellipse. To effect this adjustment of the cross-head, I employ a crank or arm, *o*, the base of which is secured to the lower end of a vertical shaft, *p*, which is supported and revolves in a bearing, *q*, in the center of a horizontal beam, *r*, which spans centrally the tops of the bars *a a* of the frame A, and with this crank, and adjustable upon it, I employ a tubular hub, *s*, provided with a clamp-screw, *t*, for confining it to said crank, this hub *s* having a pendent spur or wrist-pin, *u*, which enters a longitudinal channel or groove, *v*, in the upper part of the cross-head H′, and operating with a scale of divisions of inches and fractions of an inch engraved upon the top of the arm or crank *o*. Furthermore, to the upper end of the shaft *p* I affix the base of an additional horizontal crank or arm, *w*, arranged parallel with the crank *o*, and having a fixed hub or wrist-pin, *x*, which is pivoted to the center of the frame F, before mentioned.

The relative positions of the crank *o*, adjustable wrist-pin or hub *s*, and cross-head H′ in relation to the pen-stock are such that the sweep *n* and the knife or pen, if the hub is properly adjusted, will always be normal to the curve described by such knife or pen, and as the length of movement of the cross-head or carriage varies with every change in the size of the ellipse, a table should be provided to accompany each instrument, giving the correct distance to be set off on the crank *o* to effect the proper adjustment of the hub *s*. This distance is a ratio depending upon the two axes or diameters of the ellipse, and may be expressed by the following formula: $\frac{A^2-B^2}{A}$. In this formula, A is one-half the longest diameter and B is one-half the shortest diameter.

Fig. 4 of the accompanying drawings shows a table computed for the above purpose. As an example, suppose an ellipse is wanted three and one-half inches long and two inches wide. Preparatory to drawing or cutting such an ellipse its major axis is drawn upon the paper or other material, and the instrument placed over it in the proper position with the rod *d* parallel with such axis. The hubs E′ E′ are adjusted to the one and three-quarter inch division (which is one-half the length of the ellipse) of the scale upon the arms D′ D′ and the hubs E E to the one-inch division (which is one-half the width of the ellipse) of the scale upon the arms D D. Recourse is now had to the table and the number at the intersection of the divisions $1\frac{3}{4}$ and 1 found, which is $1\frac{1}{4}$ inch. This is to be laid off on the arm or crank *o*—that is to say, the hub *s* upon this crank is to be set at this division on said crank. The user now seizes the handle *i*, and by means of it

causes the frame F to describe a complete circle, the result being that the knife or pen is caused to describe an ellipse by the combined movements of the cranks D D D′ D′ and rods *d d′*, acting upon the hub H and pen-stock G, as before explained.

I claim—

1. In combination with the rectangular frame A, the cranks D D D′ D′, rods *d d′*, and hub H, the pivots of the rods being adjustable upon the respective cranks, and the whole being arranged to carry the stock in an elliptical path of movement, substantially as described.

2. As a means of actuating the cranks D D D′ D′, the cranks C C C′ C′, secured to the axes of the former, and being in their turn united by connecting-rods which compel them to rotate in unison, substantially as stated.

3. As a means of accelerating or retarding the speed of rotation of the stock upon its axis to maintain the knife or pen normal to the curve of the ellipse, as stated, the cross-head H′, adapted to traverse the frame A in the same direction as the rod *d′*, and actuated by the cranks *o* and *w*, and the slotted plate or arm *n*, affixed at its base to the stock and straddling a pivot depending from the cross-head, substantially as herein set forth and described.

4. The instrument as an entirety consisting of the frame A, cranks C C C′ C′ D D D′ D′, slides or rods *d d′*, connecting rods or bars *h h h′ h′* of the frame F, cross-head H, with its stud or pivot *l*, and adapted to traverse the frame A, and slotted plate or arm *n*, straddling such pivot *l*, substantially as and for purposes described.

In testimony whereof I affix my signature in presence of two witnesses.

EZRA E. CLARK.

Witnesses:

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F. CURTIS.